

NEOPERLA COOSA (PLECOPTERA: PERLIDAE), A NEW STONEFLY SPECIES FROM ALABAMA¹

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ABSTRACT: *Neoperla coosa*, a new stonefly species, is described from male, female and egg stages. The species resembles *Neoperla osage* from the Ozark Mountains, but the male aedeagus is more similar to that of *Neoperla clymene*. The new species is known only from the Coosa and Cahaba drainage systems of Alabama.

During a scanning electron microscopy study of chorionic variability among Alabama and Mississippi *Neoperla*, several populations from the Coosa and Cahaba systems with distinctive eggs were found. These eggs were quite unlike those of known *Neoperla* from the southeastern United States (Stark and Baumann 1978; Stark and Lentz 1988; Stark 1995) and subsequently the females were found to be associated at several localities with males misidentified as *N. clymene* (Newman). Because the eggs closely resemble those of *N. osage* Stark and Lentz, comparisons were made of the male and female genitalia of these species. Results of this study suggest the Coosa-Cahaba specimens represent a previously unrecognized species of the *N. clymene* complex. Terminology for the description follows Stark and Lentz (1988) and Stark (1995). The holotype is deposited in the United States National Museum of Natural History (USNM) and paratypes are deposited in the University of Alabama (UA) or in the collection of the junior author (BPS).

***Neoperla coosa*, NEW SPECIES**

Male.—Forewing length 9–11 mm. General color pale brown, head pale except for dark ocellar and mesal clypeal areas. Wing membrane and veins brown. Legs brown, cerci pale. Process of tergum 7 apically truncate, upturned in lateral aspect, armed ventrally with prominent sensilla basiconica. Mesal sclerite of tergum 8 triangular. Hemiterga rounded apically; finger-like process of hemiterga slender and relatively straight (Fig. 1). Tube of aedeagus slightly sinuate, ca. four times as long as bulb width (Fig. 2); spicule patch relatively prominent along dorsobasal to dorsomesal sides and margins of tube (Figs. 2, 10). Sac unarmed in basal third, apical sac armature of scattered, large and small spines (Fig. 2). Apex of tube curved slightly ventrad (Fig. 2).

Female.—Forewing length 11–13 mm. Color pattern similar to male. Posterior margin of sternum 8 sinuate, mesal portion slightly produced to approximate level of adjacent lateral areas (Fig. 3). Spermathecal stalk robust and irregularly armed with fine brown setae; apex of armature truncate with subapical basally directed extensions (Fig. 4).

Egg.—Length ca. 331.0 ± 7.0 μm ; equatorial width ca. 181.1 ± 3.9 μm . Collar sessile,

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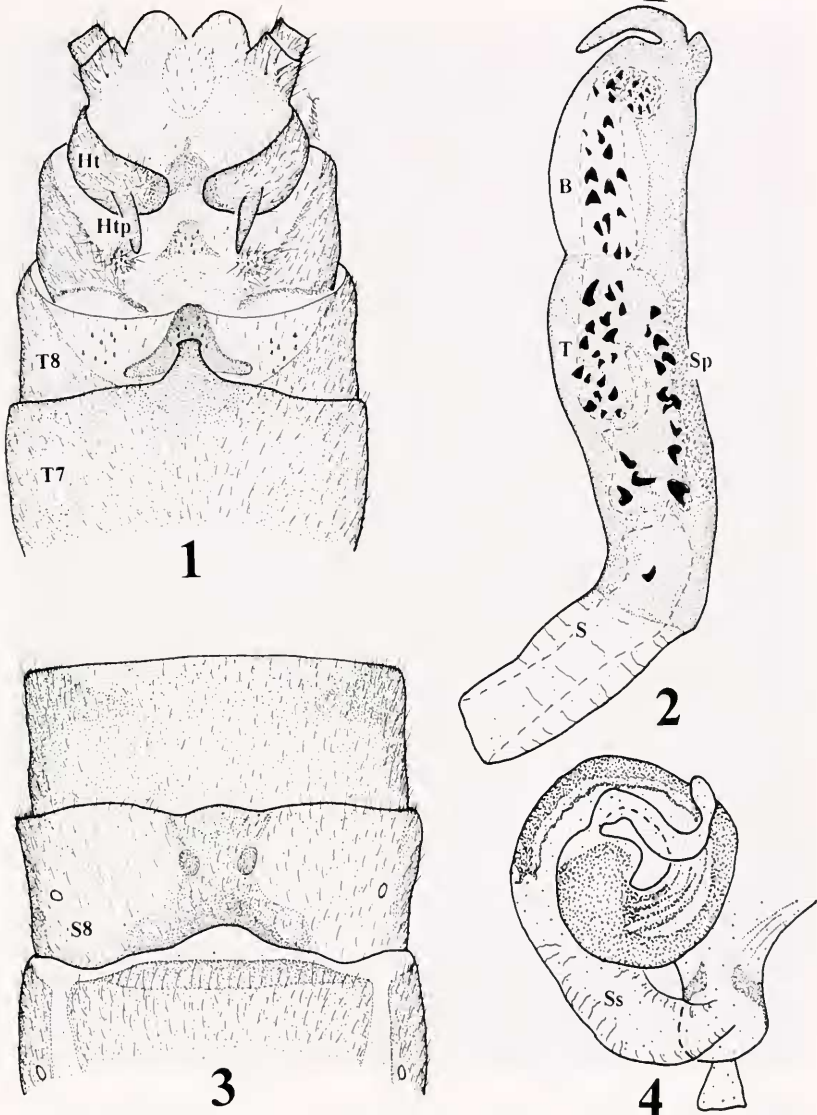
surrounded by two irregular rows of reticulation; collar diameter ca. $66.7 \pm 1.4 \mu\text{m}$ (Fig. 7). Striae slender near poles, widening at equator to ca. $12.9 \pm 0.6 \mu\text{m}$ (Fig. 5). Number of visible striae from anterior aspect ca. 38. Most striae connect directly to posterior follicle cell impression walls (FCIs), some arise from stalks of FCIs (Fig. 8). Sulci punctate with 2-3 rows of aeropyles (Fig. 6); equatorial width of sulci ca. $1.3 \pm 0.2 \mu\text{m}$. Micropyles form an irregular row displaced slightly from equator toward posterior pole; micropylar orifices simple, without raised lip. Posterior pole covered with FCIs containing ca. 21.8 ± 2.5 aeropyles. FCI walls smooth and slightly thinner than adjacent striae (Figs. 5, 8).

Types.— Holotype ♂ and 41 ♀ paratypes from Yellowleaf Creek, Jumbo, Chilton County, Alabama, 5 July 1989, P. O'Neil, S. McGregor (Holotype and 1 ♀ paratype deposited at the National Museum of Natural History). Additional paratypes, all from Alabama: Cherokee Co. Spring Creek, Hwy 87, 27 June 1989, S. Harris, S. McGregor, 2 ♀ (UA). Chilton Co. Yellowleaf Creek, 2.5 mi SE Mineral Springs, 6 June 1989, 4 ♀ (UA). Walnut Creek, N Refuge Church, 5 July 1989, P. O'Neil, S. McGregor, 1 ♂, 17 ♀ (BPS). Clay Co. Cheaha Creek, abv. Lake Chinnabee, 3 June 1978, B. Stark, K. W. Stewart, 1 ♂ (BPS). DeKalb Co. Little River at Bear Creek, 22 June 1987, 5 ♂, 98 ♀ (BPS). Elmore Co. Fischer Creek, 3.5 mi SW Weako, 24 June 1987, S. Harris, P. O'Neil, 2 ♂, 3 ♀ (UA). Jefferson Co. Cahaba River, Trussville, 24 May 1981, S. Harris, P. O'Neil 3 ♀ (UA). Cahaba River, I-59, 14 August 1984, S. Harris, P. O'Neil, 1 ♂, 1 ♀ (UA). Shelly Co. Camp Branch Creek, Hwy 42, 17 June 1984, S. Harris 2 ♂, 5 ♀ (BPS).

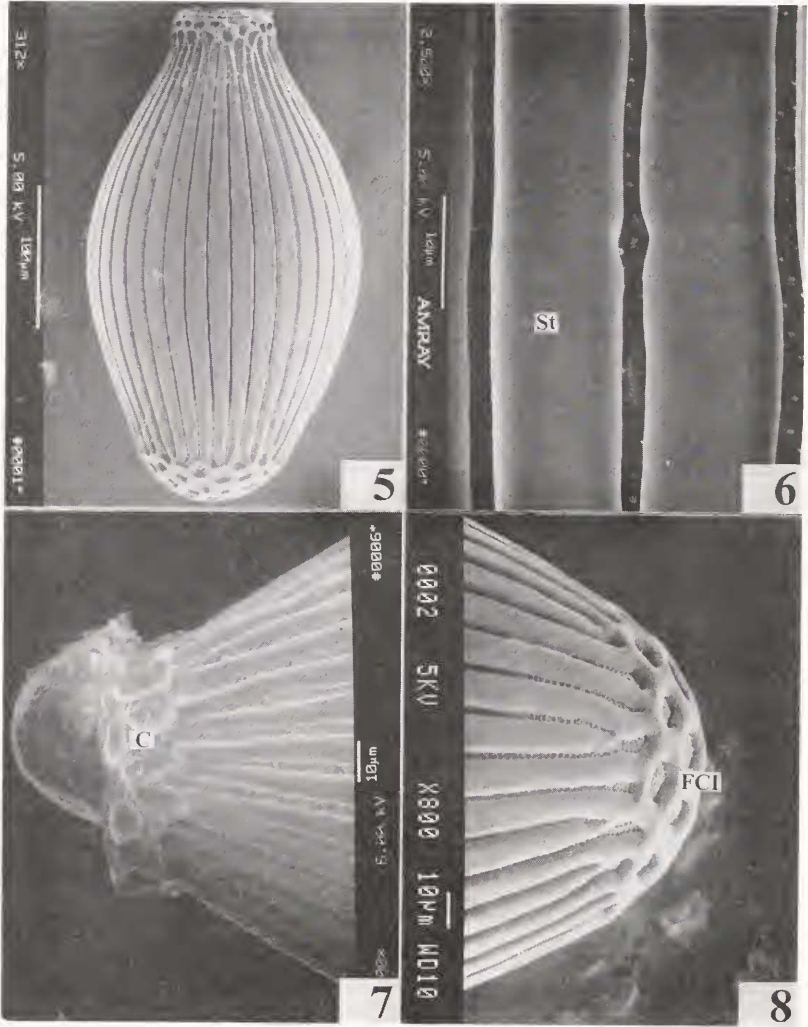
Etymology.— The species name is based on the Coosa River.

Diagnosis.— The aedeagal tube of male *N. coosa* is generally similar to that of the group of species in which an abrupt bend at tube midlength is lacking. In the southeastern United States, *N. clymene* (Newman), *N. coxi* Stark, *N. harrisi* Stark and Lentz, *N. occipitalis* (Pictet), and *N. stewarti* Stark and Baumann are included, but only *N. clymene* and *N. stewarti*, of this group, are known to occur with *N. coosa*. In the most recently available species key (Stark and Lentz 1988), male *N. coosa* are identified as *N. clymene* but differences in the tube dimensions and armature permit separation of these species. The following modification of "couplet 8" from the Stark and Lentz (1988) key is offered:

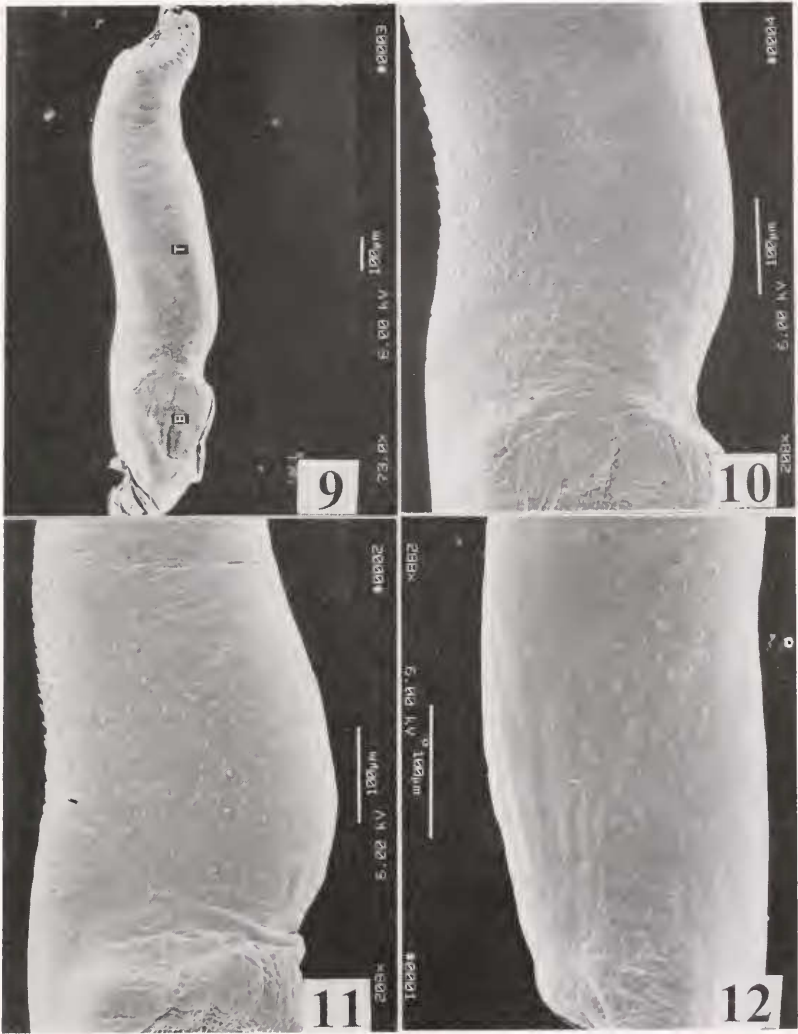
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| 8. Tube apex essentially straight along ventral margin | <i>N. occipitalis</i> |
| Tube apex curved ventrad (Fig. 2) | 9 |
| 9. Dorsobasal margin of tube weakly armed with spicules (Fig. 12); tube length ca. 6 times width at bulb | <i>N. clymene</i> |
| Dorsobasal margin of tube with prominent spicules (Fig. 10); tube length ca. 4 times width at bulb (Fig. 9) | <i>N. coosa</i> |



Figs. 1-4. *Neoperla coosa*, male and female genitalia. 1. Male terminalia, dorsal. 2. Aedeagal tube, sac partially everted, lateral, ventral side directed to the left. 3. Female sternum 7-9. 4. Vagina and spermathecal stalk, dorsal. B = bulb; T = tube; S = sac; T7 = tergum 7; T8 = tergum 8; S8 = sternum 8; Ss = spermathecal stalk; Sp = spicule patch; Ht = hemitergum; Htp = hemitergal process.



Figs. 5-8. SEM micrographs of *Neoperla coosa* eggs. 5. Egg, lateral. 6. Detail of striae. 7. Detail of collar and anchor. 8. Detail of posterior pole with FCIs. C = collar; FCI = follicle cell impression; St = stria.



Figs. 9-12. SEM micrographs of *Neoperla* aedeagal tubes. 9. *N. coosa*, lateral (B = bulb; T = tube). 10. *N. coosa*, detail of dorsolateral spicule patch. 11. *N. osage*, detail of dorsolateral spicule patch. 12. *N. clymene*, detail of dorsolateral spicule patch.

The egg (Figs. 5-8) and female subgenital plate morphology (Fig. 3) suggest *N. coosa* is most closely related to an Ozark Mountain species, *N. osage* Stark and Lentz. However, females of these species can usually be distinguished by examination of the spermathecal stalk lining. In *N. coosa* the lining resembles that of *N. robisoni* Poulton and Stewart (Ernst et al. 1986) in displaying 2-3 irregular dark longitudinal folds (Fig. 4) but in *N. osage*, the lining is more uniformly distributed over the apical third of the stalk (Stark and Lentz 1988). The aedeagal tube spicule armature is also similar for *N. coosa* and *N. osage* (Figs. 10, 11) however, the tube dimensions differ for these species. *Neoperla osage* has the aedeagal tube length about three times the bulb width (Stark and Lentz 1988) whereas in *N. coosa* the tube is about four times the bulb width.

Neoperla coosa is presently known from eight sites in the Coosa-Little River basin and two sites in the upper Cahaba River basin. All sites are above the Fall Line in the Piedmont Upland or Alabama Valley and Ridge Physiographic Section (Harris et al. 1991).

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